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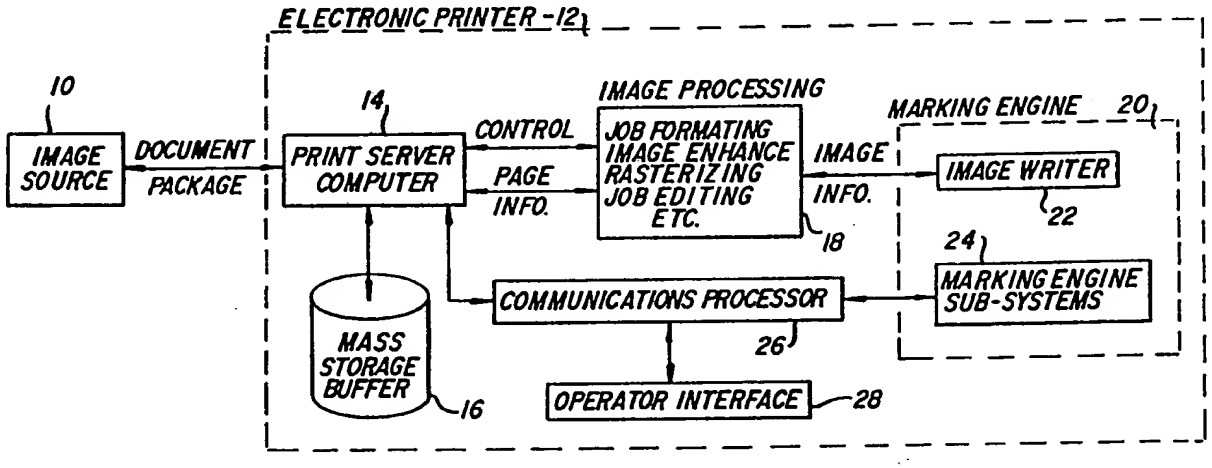

(57) Abstract

An electronic printer (12) queues a number of jobs in a mass storage buffer (16). Generally, only those jobs that do not require operator intervention are selected for printing (40), and jobs that require operator intervention are collected (44) in the printer's mass storage buffer until an operator is available (60). When the collected jobs are to be run, the special set-up required is communicated to the operator via an operator interface (66). The operator has the option of requesting all, or select, special jobs then collected in mass storage, be run at any time convenient to the operator.

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PRINTER JOB CLASSIFICATION

Description

Technical Invention

This invention relates generally to electronic printers wherein a plurality of jobs to be printed are queued in a mass storage buffer until the printer is available to run the job, and more particularly to the manner in which the next job to be printed is selected from the buffer.

Background Art

Computer work stations, word processors, document scanners, and the like produce print jobs having various set-up configurations. When these jobs are sent to a printer, operator intervention may be required to configure the printer to run the job. For example, a particular job might require legal size paper, color insert sheets, color ink or toner, secure handling, etc. If these are not already available in the printer, an operator is needed to provide them.

The jobs are generally run in a predetermined priority, such as in the order they are received (the so-called first-in, first-out sequence). This sequence may be changed by several known prioritization schemes that attempt to identify the most important job, and run it as soon as practical after it is received.

Whatever the job sequence is, it can cause inefficiencies when a job is encountered which requires an operator at the printer. If no operator is available, the printing operation stops until an operator is free. On the otherhand, stationing an operator at the printer to be available when needed is not cost effective.

Disclosure of Invention

Accordingly, it is an object of the present

invention to classify jobs as to whether they require operator intervention or not.

It is another object of the present invention that those jobs that require operator intervention, based on the printer's current configuration, be collected in the printer's mass storage buffer until such time when an operator is available.

It is still another object of the present invention that when the collected jobs are to be run, that the special set-up required be communicated to the operator via an operator interface.

It is yet another object of the present invention that the operator have the option of requesting all, or select, special jobs then collected in mass storage, be run at any time convenient to the operator.

In accordance with the above objects, the present invention provides an electronic printer having a mass storage buffer for receiving and queuing a plurality of jobs. Generally, only those jobs that do not require operator intervention are selected for printing, and jobs that require operator intervention are collected in the printer's mass storage buffer until an operator is available.

The invention, and its objects and advantages, will become more apparent in the detailed description of the preferred embodiments presented below.

Brief Description of the Drawings

In the detailed description of the preferred embodiments of the invention presented below, reference is made to the accompanying drawings, in which:

Figure 1 is a simplified schematic diagram of an electronic printer according to the present invention;

Figure 2 is a logic flow diagram of the operation of the printer of Figure 1;

Figure 3 is another embodiment of the logic flow diagram of the operation of the printer of Figure 1;

Figure 4 is yet another embodiment of the logic flow diagram of the operation of the printer of Figure 1; and

Figure 5 is still another embodiment of the logic flow diagram of the operation of the printer of Figure 1.

Best Mode for Carrying Out the Invention

Referring to Figure 1, an image source 10, such as a host computer, document scanner, or other digitized information source, generates a document package, which is also referred to as a print job. Each print job consists of document information, job priority information if any, and the preferred printer configuration required for finishing. Such information may be stated explicitly or embedded in the content of the job. Printer configuration includes such selectable set-up parameters as paper size, number of prints and sets, color selection, and optionally acceptable substitute set-up configuration if any. The document information consists of text, images, graphics, composition, fonts, and styles.

The document package is delivered to an electronic printer 12 and becomes the input to a print server computer 14. The print server computer moves the print jobs into a mass storage buffer 14, and provides a means to run an algorithm, discussed in detail below, which will determine the sequence that the jobs will be retrieved from mass storage and printed. All the following algorithms could be performed by the print server computer, or they could be performed by a second processor, with the print

server computer being assigned responsibility for accepting jobs from the image source only.

The print server computer also sends document information and control signals to an image processing unit 18 that provides a means of print job formatting, image enhancement, job editing, image buffering, rasterization, and other conventional image processing function. The image information is sent to a marking engine 20 having an image writer 22, such as a light emitting diode array, laser writer, ion deposition head, ink jet or other means of writing an image.

Sub-systems 24 within marking engine 20 supply printer configuration, sub-system conditions, and material status information to a communications processor 26. Communications processor 26 provides a link between the marking engine, print server computer 14, and an operator interface 28. Operator interface 28 is capable of providing information to, and receiving information from, an operator attending the printer. Information about machine configuration material status such as size of the paper or color of the toner that is present in the machine, is sent to the print server computer, along with any operator preferences as defined on the operator interface.

Figure 2 is a logic flow diagram of the algorithm used to determine the order in which jobs are selected by the print server computer from the mass storage buffer of Figure 1. The algorithm enters a functional block 30 where all jobs in the buffer are read by the print server computer. As the algorithm enters a functional block 32 all of the jobs are flagged "READY". At a decisional block 34, the algorithm determines if there are any "READY" jobs.

If there are "READY" jobs to be run, the algorithm enters a functional block 36 where the jobs are preliminarily arranged into a preferred order or sequence as discussed below with respect to Figure 3. Still referring to Figure 2, the algorithm moves to a decisional block 38 to determine if the job requires an operator to interface with the printer before the job can be printed. The various reasons that operator interface might be required are discussed below with respect to Figure 4.

If the job can be processed without operator interface, the algorithm moves to a functional block 40 and the job is printed. The algorithm moves through a block 42 where the job is removed from the buffer, and the algorithm returns to block 32 to allow processing the remaining buffered jobs.

If however, the job requires operator interface at decisional block 38, the algorithm enters a functional block 44, whereat a software "NOT-READY" flag is set and an operator interface indicator, such as a light or message display, is turned on. Without printing the job, the algorithm is re-entered above decisional block 34 for selection of the next "READY" job. The "NOT-READY" job has been set aside and will not be re-evaluated until there are no more "READY" jobs at decisional block 34. If the interface indicator is a message, a message buffer is established which, when an operator indicates his or her presence, will display a list of actions need be taken to allow printing of jobs on a job priority and/or operator convenience (e.g., minimal changes) basis.

Now, if there are no "READY" jobs in the buffer at decisional block 34, the buffer is either totally empty or contains only jobs that have been determined to be "NOT-READY" and which require

operator interface. The algorithm enters a decisional block 46 to determine if the buffer is empty. If the buffer is empty, the algorithm enters a functional block 48 and the machine turns the operator interface indicator off. The algorithm returns to block 32, and then cycles around blocks 32, 34, 46, 48, and back to 32 until another job is sent from image source 10.

If the buffer is not empty at decisional block 46, it will contain only "NOT READY" jobs. The algorithm leaves the operator interface indicator on to alert the operator and returns to block 32 where all jobs are set "READY" again. The algorithm continues to loop until a new job is received or the operator changes the machine configuration.

Figure 3 shows another embodiment of the algorithm used to determine the order in which jobs are selected by print server computer 14 to be printed. In Figure 3, all logic blocks having the same function as in Figure 2 have been assigned the same reference number.

The algorithm enters functional block 30, whereas all jobs in the buffer are read by the print server computer. As the algorithm enters functional block 32, all of the jobs are made "READY".

If there are "READY" jobs to be run, the algorithm enters complex block 36. The jobs are preliminarily arranged into a preferred order or sequence in a functional block 52 such that all jobs that are stored in the mass storage buffer that have the highest priority, as defined within the document package from the image source, are selected as a set. The algorithm then enters a functional block 54 whereas the oldest job of the set is selected.

The algorithm moves to complex block 38 which, as in Figure 2, allows the print server

computer to determine if the job will be printed immediately or if it will be postponed until a later time because of a need for operator intervention.

Within complex block 38, a decisional block 56 allows the algorithm to determine if the job requires an operator to interface with the printer before the job can be printed. If the job can be processed without operator interface, the algorithm moves to functional block 40 and the job is printed, the algorithm moves to block 42 and the job is removed from the buffer and the algorithm returns to block 32 to allow processing the remaining buffered jobs.

If however, decisional block 56 determines that the job requires an operator to interface with the printer before the job can be run, the algorithm enters a decisional block 58. Decisional block 58 allows the algorithm to determine if the priority level of the job requires that it be printed next or if the job can be postponed while other jobs that do not require an operator are run. Decisional block 60 allows the algorithm to determine if an operator has requested to run the "Operator Interface" jobs at this time. If the decisions made within the algorithm during blocks 58 or 60 require that the job be run immediately, the algorithm moves to a functional block 62 and the operator interface alerts the operator to the conditions that require attention.

The algorithm moves to block 40 and the job is printed, and then the algorithm enters block 42, whereat the job is removed from the mass storage buffer. The algorithm is re-entered at block 32 to allow processing of the remaining buffered jobs.

If the complex block 38 algorithm determines that the job requires interface (block 56), is not above a predetermined priority threshold (block 58),

and an operator is not standing by (block 60), the algorithm advances to complex block 44. Block 44 is shown in more detail in Figure 3 than in Figure 2, and includes a functional block 64, whereat a software "NOT-READY" flag is set, and a block 66 whereat the machine outputs a signal from the print server computer to the communications processor and turns on the "Job Present Indicator" on operator interface 28 (see Figure 1) that alerts an operator that there is a job in the buffer that will require operator intervention before it can be run, and the printer stops until such intervention takes place. The algorithm is then re-entered, at block 34, for selection of the next "READY" job. The "NOT-READY" job has been set aside and will not be re-evaluated until the decision has been made within the algorithm at block 34 that there are no more "READY" jobs in the mass storage buffer.

If there are no "READY" jobs in the buffer, as determined within decisional block 34, the buffer is either totally empty or only has jobs that have been determined to be "NOT-READY" and require operator interface before the job can be run. Within decisional block 46, the algorithm allows the print server computer to determine if the buffer is empty, by checking the status of the "NOT READY" flag.

If the "NOT READY" flag is not set, meaning that the buffer is totally empty, the algorithm moves into functional block 48, whereat a signal is output from the print server computer to the communications processor and turns "OFF" the "Job Present Indicator" on the operator interface (see Figure 1), the algorithm returns to block 32, and then cycles between blocks 32, 34, 46, 48, and back to 32 until another job is sent from the image source and stored into the mass storage buffer (see Figure 1).

If the "NOT READY" flag is set, meaning that there are "NOT READY" jobs to be run, the algorithm advances to a functional block 68 whereat the "NOT READY" flag is cleared. In a block 70, a signal is output from the print server computer to the communications processor that sends a message to the operator interface (see Figure 1) alerting the operator that there are no jobs in the buffer that will not require attention before it can be run.

The algorithm is then re-entered at block 32 and then cycles between blocks 32, 34, 52, 54, 56, 58, 60, 64, 66, 34, 46, 68, 70, and back to 32 until the operator inputs an "Operator Present" signal to operator interface 28, which sends a signal through the communications processor to the print server computer that an operator is present at the machine. Now when the algorithm reaches decisional block 60, the operator is determined to be present and the algorithm advances to functional block 62, whereat the operator is alerted to the conditions that require attention via the messages mentioned previously. The algorithm moves to block 40 and the job is printed. Then the algorithm enters block 42, whereat the job is removed from the mass storage buffer. The algorithm is re-entered at block 32 to allow processing of the remaining buffered jobs.

In Figure 4, complex block 38' is a second embodiment of block 38 of Figs. 2 and 3. As in the first embodiment, the purpose of complex block 38' is to allow the algorithm to determine if the current job will be run or if it can be postponed until a later time. During the execution of this complex block, the print server computer reviews the requirements of the job as defined by the document package and stored in coded form in the mass storage buffer, reviews the printer configuration and

materials status as reported by the marking engine sub-systems to the print server computer via the communications processor, and reviews the operator preferences as reported by the operator interface to the print server computer via the communications processor. The print server computer then determines if the current print job can or should be run next, or if it should be postponed until a later time.

The algorithm enters various decisional blocks 100_1, 100_2, ..., 100_n, whereat the print server computer makes a comparison of the job requirements and the current printer status to determine if any operator intervention is required before the job can be run. Optional alternatives to blocks 100_1 criterion are explored when the algorithm advances to block 102_1. The algorithm compares the priority of the job to a priority threshold value, that can be selectively programmed either by the machine operator or by the operator of the image source, in blocks 104_1, 104_2, ..., 104_n. As the algorithm moves to blocks 106_1, 106_2, ..., 106_n, the print server computer checks the operator interface, via the communications processor, to determine if the operator has pressed an "Operator Present" button, indicating the operator's preference to run jobs that require operator intervention. If the printer configuration is not correct for the job but priority or operator preference requires the job to be run, the algorithm advances to blocks 108_1, 108_2, ..., 108_n whereat the operator is informed about the necessary changes. When the changes have been made, blocks 110_1, 110_2, ..., 110_n permit resumption of printing. Figure 4 gives three examples of sets of algorithm inquiries, but the concept is not limited to these examples.

Figure 5 is an embodiment of the present invention that differs from Figure 3 only in the position of the "Priority Selection" block 52". In this embodiment, all jobs of each successive priority are completed before the printer selects the next priority category.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

Claims

1. An electronic printer having a mass storage buffer for receiving and queuing a plurality of jobs to be printed until the printer is available to run the job, the improvement comprising:

means for classifying the jobs as to whether or not they require intervention of an operator attending the printer;

means for selectively printing only those jobs that do not require operator intervention and for selectively collecting in the printer's mass storage buffer those jobs that require operator intervention; and

means for selectively printing the collected jobs following operator intervention, whereby the jobs that require operator intervention can be printed as a group when the operator is available.

2. An electronic printer as defined in Claim 1 further comprising:

an operator interface capable of providing information to an operator attending the printer; and

means for communicating to the operator via said operator interface that there are jobs collected in the mass storage buffer that require operator intervention.

3. An electronic printer as defined in Claim 1 further comprising:

an operator interface capable of providing information to an operator attending the printer; and

means for communicating to the operator via an operator interface (1) that there are jobs collected in the mass storage buffer that require operator intervention and (2) what the required operator intervention is.

4. An electronic printer as defined in Claim 1 further comprising means selectively usable by an operator for running, at any time convenient to the operator, jobs collected in the printer's mass storage buffer as requiring operator intervention, whereby the jobs that require operator intervention can be run when desired.

5. An electronic printer as defined in Claim 1 further comprising:

means for dividing the plurality of jobs into sets by priority; and

means for classifying the jobs within the sets by priority.

6. An electronic printer as defined in Claim 5 further comprising means for alerting the operator to the presence of a high priority job that requires operator intervention to run.

7. An electronic printer as defined in Claim 6 further comprising means for interrupting printing until any jobs above a predetermined priority threshold have been printed, whether or not they require operator intervention.

8. A process for printing a plurality of jobs queued in a mass storage buffer, the process comprising the steps of:

classifying the jobs as to whether or not they require intervention of an operator attending the printer; and

selectively printing only those jobs that do not require operator intervention and selectively collecting in the printer's mass storage buffer those jobs that require operator intervention, whereby the jobs that require operator intervention can be run as a group when the operator is available.

9. The process as defined in Claim 8 further comprising the step of communicating to the

operator via an operator interface that there are jobs keep in the mass storage buffer that require operator intervention.

10. The process as defined in Claim 8 further comprising the step of communicating to the operator via an operator interface (1) that there are jobs keep in the mass storage buffer that require operator intervention and (2) what the requirer operator intervention is.

11. The process as defined in Claim 8 further comprising the steps of:

dividing the plurality of jobs into sets by priority; and

classifying the jobs within the sets by priority.

12. The process as defined in Claim 11 further comprising the step of alerting the operator to the presence of a high priority job that requires operator intervention to run.

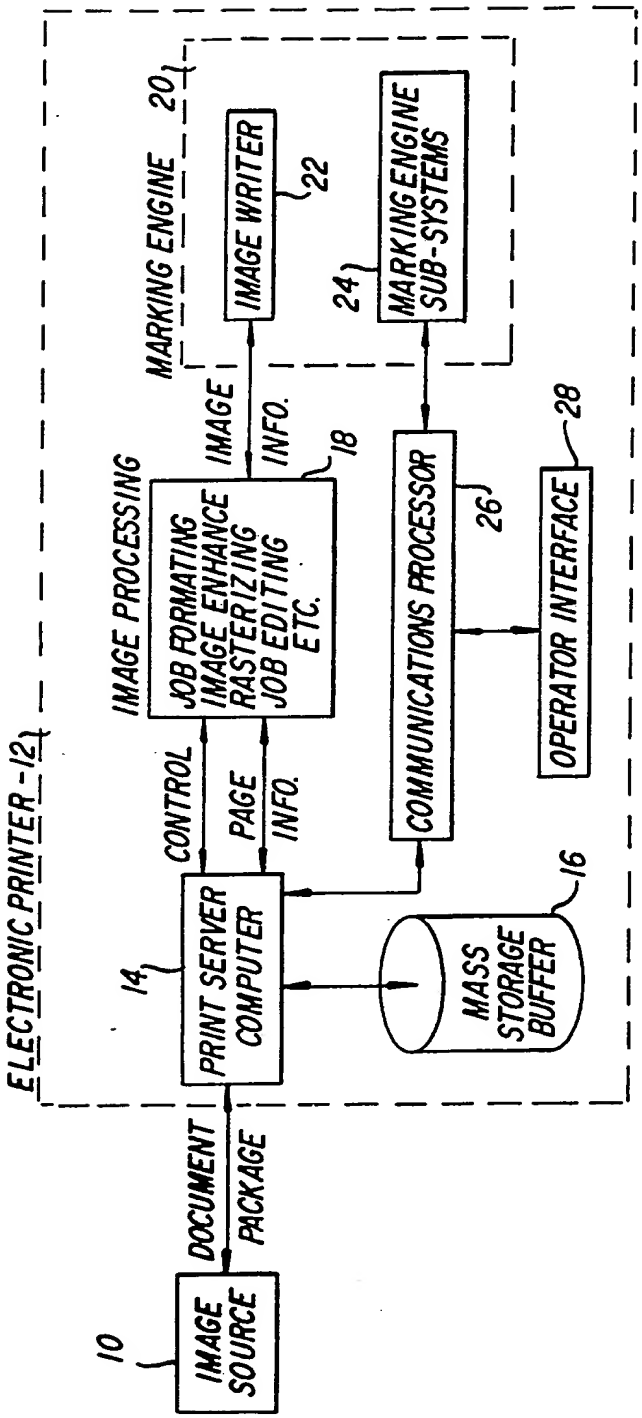
ELECTRONIC PRINTER
12
IMAGE SOURCE
10
DOCUMENT
PACKAGE
PRINT SERVER COMPUTER
14
CONTROL
PAGE INFO.
IMAGE PROCESSING
JOB FORMATING
IMAGE ENHANCE
RASTERIZING
JOB EDITING
ETC.
18
IMAGE INFO.
MARKING ENGINE
20
IMAGE WRITER
22
MARKING ENGINE SUB-SYSTEMS
24
COMMUNICATIONS PROCESSOR
26
OPERATOR INTERFACE
28
MASS STORAGE BUFFER
16

FIG. 1

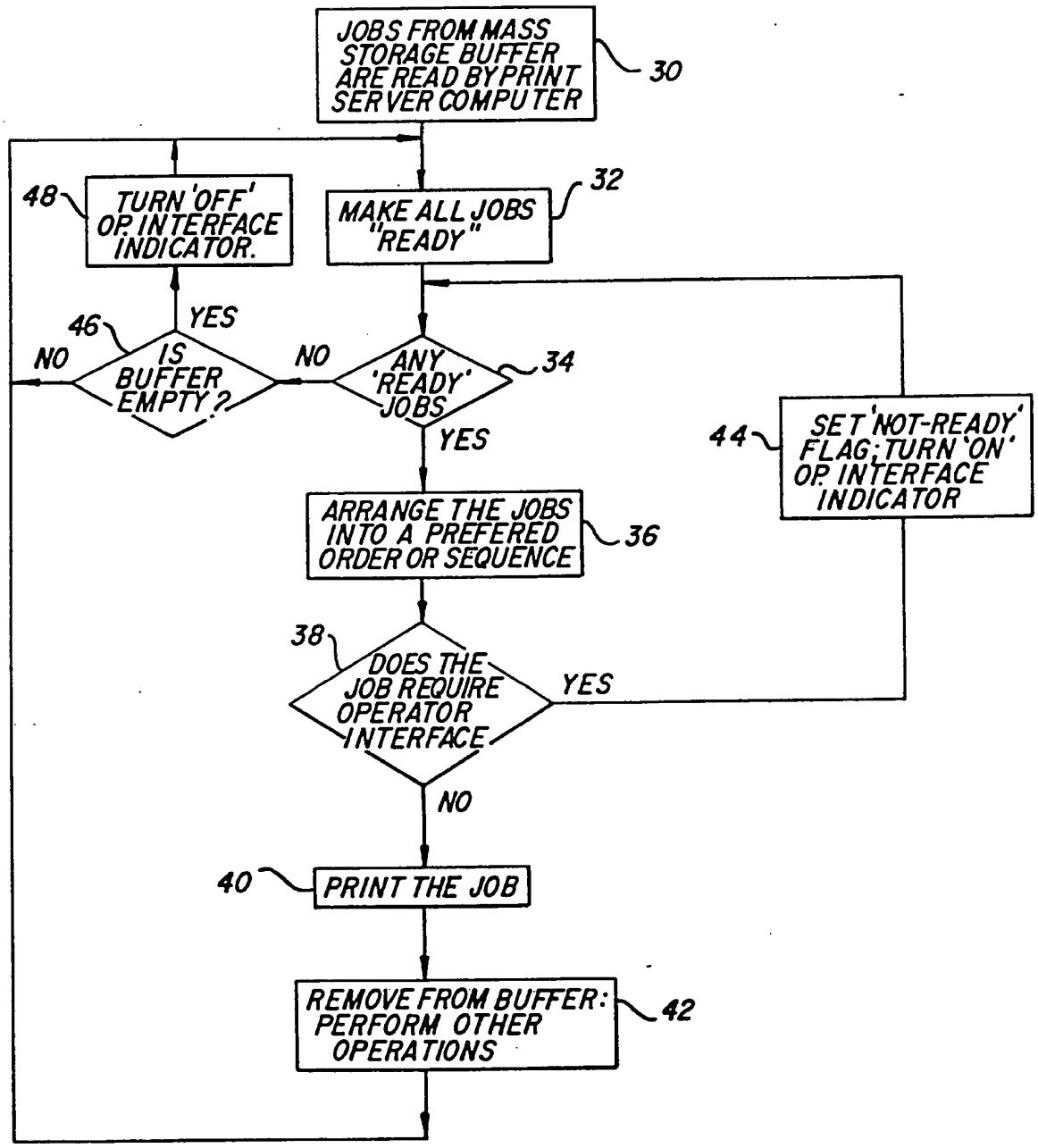
JOBS FROM MASS STORAGE BUFFER ARE READ BY PRINT SERVER COMPUTER
30
MAKE ALL JOBS "READY"
32
ANY 'READY' JOBS
34
NO
YES
IS BUFFER EMPTY?
46
NO
YES
TURN 'OFF' OP. INTERFACE INDICATOR.
48
SET 'NOT-READY' FLAG; TURN 'ON' OP. INTERFACE INDICATOR
44
ARRANGE THE JOBS INTO A PREFERED ORDER OR SEQUENCE
36
DOES THE JOB REQUIRE OPERATOR INTERFACE
38
YES
NO
PRINT THE JOB
40
REMOVE FROM BUFFER: PERFORM OTHER OPERATIONS
42

FIG. 2

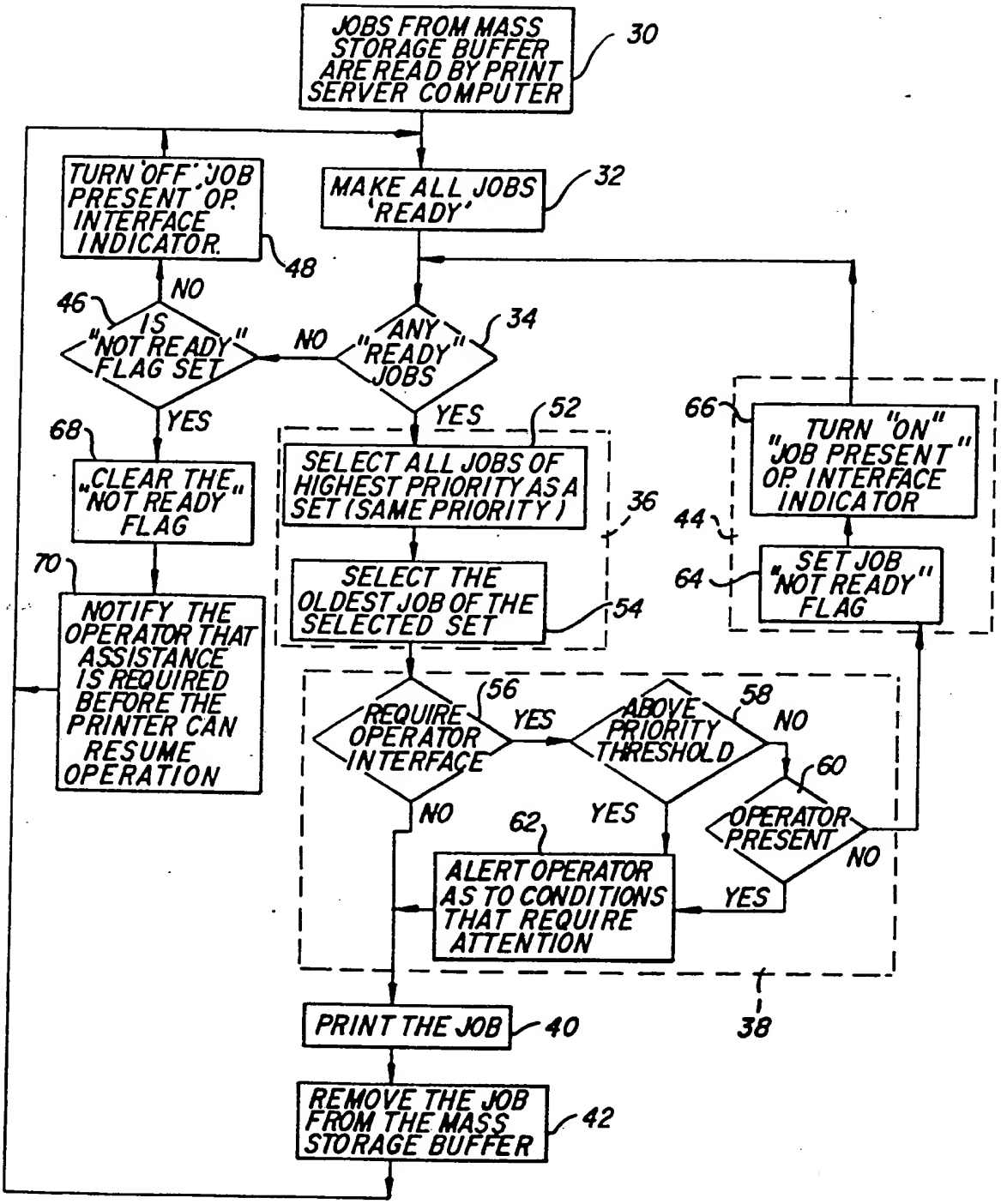
JOBS FROM MASS STORAGE BUFFER ARE READ BY PRINT SERVER COMPUTER
30
MAKE ALL JOBS 'READY'
32
ANY "READY" JOBS
34
NO
YES
TURN 'OFF' JOB PRESENT OP. INTERFACE INDICATOR.
48
IS "NOT READY" FLAG SET
46
NO
YES
"CLEAR THE" "NOT READY" FLAG
68
NOTIFY THE OPERATOR THAT ASSISTANCE IS REQUIRED BEFORE THE PRINTER CAN RESUME OPERATION
70
SELECT ALL JOBS OF HIGHEST PRIORITY AS A SET (SAME PRIORITY)
52
36
SELECT THE OLDEST JOB OF THE SELECTED SET
54
REQUIRE OPERATOR INTERFACE
56
YES
NO
ABOVE PRIORITY THRESHOLD
58
YES
NO
OPERATOR PRESENT
60
YES
NO
ALERT OPERATOR AS TO CONDITIONS THAT REQUIRE ATTENTION
62
38
PRINT THE JOB
40
REMOVE THE JOB FROM THE MASS STORAGE BUFFER
42
TURN "ON" "JOB PRESENT" OP. INTERFACE INDICATOR
66
44
SET JOB "NOT READY" FLAG
64

FIG. 3

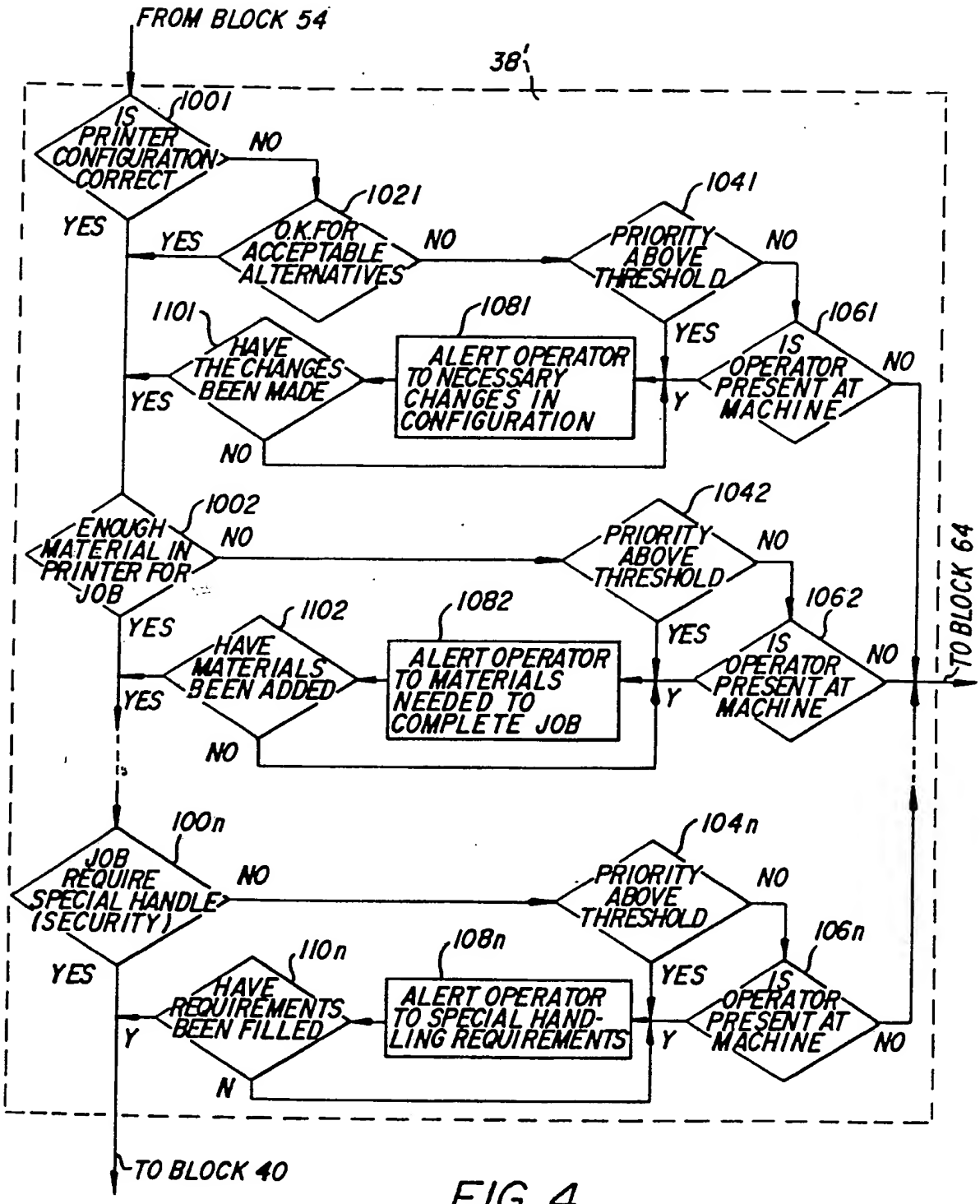
FROM BLOCK 54
38'
1001
IS PRINTER CONFIGURATION CORRECT
NO
YES
1021
O.K. FOR ACCEPTABLE ALTERNATIVES
YES
NO
1041
PRIORITY ABOVE THRESHOLD
NO
YES
1101
HAVE THE CHANGES BEEN MADE
YES
NO
1081
ALERT OPERATOR TO NECESSARY CHANGES IN CONFIGURATION
Y
1061
IS OPERATOR PRESENT AT MACHINE
NO
1002
ENOUGH MATERIAL IN PRINTER FOR JOB
NO
YES
1042
PRIORITY ABOVE THRESHOLD
NO
YES
1102
HAVE MATERIALS BEEN ADDED
YES
NO
1082
ALERT OPERATOR TO MATERIALS NEEDED TO COMPLETE JOB
Y
1062
IS OPERATOR PRESENT AT MACHINE
NO
TO BLOCK 64
100n
JOB REQUIRE SPECIAL HANDLE (SECURITY)
NO
YES
104n
PRIORITY ABOVE THRESHOLD
NO
YES
110n
HAVE REQUIREMENTS BEEN FILLED
Y
N
108n
ALERT OPERATOR TO SPECIAL HANDLING REQUIREMENTS
Y
106n
IS OPERATOR PRESENT AT MACHINE
NO
TO BLOCK 40

FIG. 4

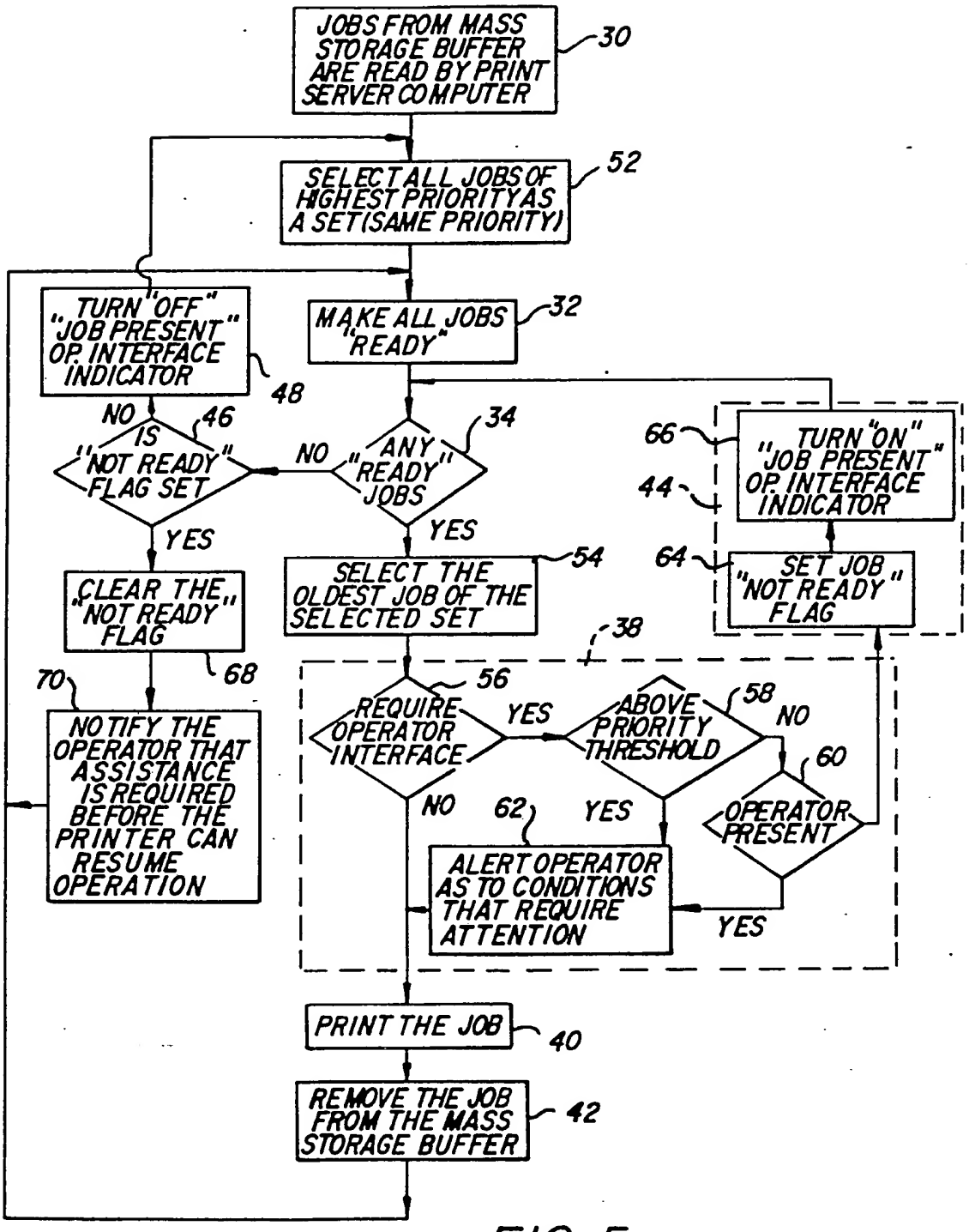
JOBS FROM MASS STORAGE BUFFER ARE READ BY PRINT SERVER COMPUTER
30
SELECT ALL JOBS OF HIGHEST PRIORITY AS A SET (SAME PRIORITY)
52
TURN "OFF" "JOB PRESENT" OP. INTERFACE INDICATOR
48
MAKE ALL JOBS "READY"
32
NO
IS "NOT READY" FLAG SET
46
NO
ANY "READY" JOBS
34
YES
YES
66
TURN "ON" "JOB PRESENT" OP. INTERFACE INDICATOR
44
64
SET JOB "NOT READY" FLAG
CLEAR THE "NOT READY" FLAG
68
SELECT THE OLDEST JOB OF THE SELECTED SET
54
38
70
56
REQUIRE OPERATOR INTERFACE
YES
ABOVE PRIORITY THRESHOLD
58
NO
60
NO
62
YES
OPERATOR PRESENT
NOTIFY THE OPERATOR THAT ASSISTANCE IS REQUIRED BEFORE THE PRINTER CAN RESUME OPERATION
ALERT OPERATOR AS TO CONDITIONS THAT REQUIRE ATTENTION
YES
PRINT THE JOB
40
REMOVE THE JOB FROM THE MASS STORAGE BUFFER
42

FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 88/04655

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: G 06 K 15/00; G 06 F 3/12

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	G 06 K; G 06 F

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	EP, A, 0208342 (OCE-NEDERLAND) 14 January 1987, see figure 1; column 1, lines 14-33; column 2, lines 37-45; column 3, line 27 - column 6, line 23 --	1-4,8-10
A	Proceedings of the 12th Conference on Local Computer Networks, 5-7 October 1987 Minneapolis, Minnesota (US) B. Cummiskey et al.: "Distributed print management", pages 160-166, see page 161, right-hand column, paragraph 2 - page 165, paragraph 2 --	1-5,8-11
A	IBM Technical Disclosure Bulletin, vol. 25, no. 5, October 1982 Yorktown Heights (US) T.L. Adam: "Method for fairsharing of a printer by multiple display stations", pages 2664-2665, see the whole document --	1
A	EP, A, 0123806 (IBM) 7 November 1984, see page 1, paragraphe 2 - page 2, paragraph 5	1

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
13th April 1989	16. 05. 89
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	P.C.G. VAN DER PUTTEN

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 8804655 SA 26257

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 02/05/89
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0208342	14-01-87	NL-A- 8501888	01-04-86
		JP-A- 62008222	16-01-87
EP-A- 0123806	07-11-84	JP-A- 59183555	18-10-84
		US-A- 4556959	03-12-85